REMARKS

This response responds to the Office Action dated January 7, 2004 in which the Examiner rejected claims 1-40 under 35 U.S.C. §103.

Claim 1 claims a wavelength monitor, claims 3 and 37 claim a semiconductor laser device and claim 39 claims a method of monitoring a wavelength of a laser beam emitted by a semiconductor laser. The monitor, device and method include configuring a cylindrical lens to allow a laser beam emitted from a semiconductor laser to pass therethrough. First and second photodetectors receive the laser beam passing through the cylindrical lens. A wavelength filter is disposed in an optical path between the semiconductor laser and one of the photodetectors and is disposed outside the optical path between the semiconductor laser and the other photodetector.

Through the structure of the claimed invention having a cylindrical lens, as claimed in claims 1, 3, 37 and 39, the claimed invention provides a monitor, device and method in which the wavelength of a laser beam is always monitored with high precision even if the laser beam is shifted. The prior art does not show, teach or suggest the invention as claimed in claims 1, 3, 37 and 39.

Claims 1-3, 13-16, 37, 39 and 40 were rejected under 35 U.S.C. §103 as being unpatentable over *Ohshima et al.* (U.S. Patent No. 4,998,256) in view of *Wakabayashi et al.*(U.S. Patent No. 6,101,211) or *Munks* (U.S. Patent No. 6,587,214).

Applicants respectfully traverse the Examiner's rejection of the claims under 35 U.S.C. §103. The claims have been reviewed in light of the Office Action, and for

reasons which will be set forth below, Applicants respectfully request the Examiner withdraws the rejection to the claims and allows the claims to issue.

Ohshima et al. appears to disclose semiconductor laser module and a laser wavelength control apparatus used for optical communication. (col. 1, lines 6-8) Referring to FIG. 5, reference numeral 31 denotes a semiconductor laser. By changing the injection current or temperature of the semiconductor laser 31, wavelength control in a 1.55-.mu.m wavelength band can be performed. Light S.sub.1 emitted from the left side of the semiconductor laser 31 in FIG. 5 is focused on an optical fiber 34 for optical transmission through optical lenses 32 and 33. Light S.sub.2 emitted from the right side of the semiconductor laser 31 in FIG. 5 is collimated by an optical lens 35 and is split by a beam splitter 36 in two directions. One split light component S.sub.3 is focused on a first photo-detector (e.g., a photodiode) 38 through an optical lens 37. A detection output from the first photodetector 38 is used as a power monitor output. The other split light component S.sub.4 is transmitted through a Fabry-Perot resonator 39 consisting of a crystallized quartz etalon whose C axis is matched with an optical axis of the semiconductor laser 31, and is focused on a second photodetector (e.g., a photodiode) 41 through an optical lens 40. (col. 4, lines 18-37) The semiconductor laser module shown in FIG. 6 is different from that shown in FIG. 5 in the structure of a Fabry-Perot resonator 42. This Fabry-Perot resonator 42 is designed as follows. A columnar bulk 421 consisting of a first optical material (crystallized quartz in this case) and a columnar bulk 422 consisting of a second optical material (rutile in this case) are bonded to each other in such a manner that their C axes are positioned in the same direction. (col. 5, lines 31-39)

Thus, *Ohshima et al.* merely discloses an optical lens 35 for collimating a laser beam from a laser 31 and a beam splitter 36 which splits the laser beam in two directions. Nothing in *Ohshima et al.* shows, teaches or suggests a cylindrical lens which passes the laser beam therethrough as claimed in claims 1, 3, 37 and 39. Rather, *Ohshima et al.* merely discloses an optical lens 35 and a beam splitter 36.

Wakabayashi et al. appears to disclose a narrow-band laser apparatus employed as a light source for a semiconductor exposure tool for optical microlithography process. (col. 1, lines 4-6) In FIG. 1, reference numeral 1 is an angle-dispersion wavelength selection element unit, 2 is a laser tube containing laser medium, 3 is a beam folding unit that folds back a laser beam in the direction in which it was input, 4 is a beam branching unit that transmits part of the laser beam and inputs it to angle-dispersion wavelength selection element unit 1, and which operates to reflect the remaining part such that it is output as an output beam, 5 is a beam restricting unit that restricts the beam in the direction of angle-dispersion (direction A in the drawings) of angle-dispersion wavelength selection element unit 1, and 6 is a beam restriction unit that restricts the beam of the output light. (col. 5, lines 34-45) After the beam has passed through laser tube 2, it is folded back by beam folding unit 3 and again amplified by laser tube 2. (col. 5, lines 58-60) FIGS. 9(a)-9(e) illustrate modified examples of the embodiment of FIG. 5. In this embodiment, in place of the highly reflecting mirror 31 of the beam folding unit 3 of FIG. 5, by employing another beam folding unit 3 shown in FIG. 9(a)-9(e), ASE light is reduced in amount and spectral purity of the output beam is improved. (col. 9, lines 7-12) In FIG. 9(e), beam folding unit 3 is constituted by a cylindrical lens 89, slit 90, cylindrical lens 91 and plane mirror 92, so that ASE light is cut off at locations

outside the whole of slit 90. Cylindrical lens 89, slit 90 and cylindrical lens 91 may be arranged between laser tube 2 and apertured mirror 42. (col. 9, lines 32-37)

Thus, *Wakabayashi et al.* merely discloses a beam folding unit 3 formed inside a narrow band laser apparatus and where the unit 3 may be constituted by two cylindrical lenses 89, 91, a slit 90 and a plane mirror 92. Nothing in *Wakabayashi et al.* shows, teaches or suggests a cylindrical lens which passes a laser beam emitted from a semiconductor laser therethrough as claimed in claims 1, 3, 37 and 39. Rather, the beam folding unit in *Wakabayashi et al.* is part of the laser apparatus itself.

A combination of *Ohshima et al.* and *Wakabayashi et al.* would merely suggest that within the semiconductor laser 31 of *Ohshima et al.* to include the beam folding unit 3 of *Wakabayashi et al.* Therefore, nothing in the combination of *Ohshima et al.* and *Wakabayashi et al.* shows, teaches or suggests a cylindrical lens which passes a laser beam emitted from a semiconductor laser therethrough as claimed in claims 1, 3, 37 and 39.

Munks appears to disclose apparatus and methods for monitoring the wavelength and power of an optical communication signal. (col. 1, lines 8-10) FIG. 9 is a schematic diagram of a broadband wavelength, and power monitor 200 that includes a wideband thin film filter for course wavelength monitoring and a Fabry-Perot Etalon for fine wavelength monitoring. The monitor 200 includes an optical source 41, such as a tunable semiconductor laser, that generates an optical beam 42. A collimating lens (not shown) may be positioned in the path of the incident optical beam 42. A beam splitter 90 is positioned in a path of the optical beam 42. In one embodiment, the beam splitter 90 comprises a non-polarizing beam splitter. The

beam splitter 90 includes a partially reflecting mirror deposited on a hypotenuse 98 that transmits a portion of the beam in the direction of propagation of the incident beam 42 and reflects a portion of beam in the direction perpendicular to the direction of propagation of incident beam 42. The monitor 200 includes a second beam splitter 202 that is positioned in the path of the portion of beam in the direction perpendicular to the direction of propagation of incident beam 42. The second beam splitter 202 splits the reflected portion of the beam into a first 204 and a second optical path 206. In one embodiment, the second beam splitter 202 is a cylindrical lens. A first photodiode 208 is positioned in the first path 204. The first photodiode 208 generates a first electrical signal that is proportional to the optical power of the incident optical beam 42. A coarse filter 210 is positioned in the second path 206. In one embodiment, the coarse filter 210 comprises a thin film filter. The coarse filter 210 passes a relatively broadband optical signal. A second photodiode 212 is positioned after the coarse filter 210 in the second path 206. The second photodiode 212 generates a second electrical signal that is proportional to the optical power of the broadband optical signal. A Fabry-Perot Etalon 214 is positioned in the direction of propagation of the incident beam 42. A Fabry-Perot Etalon or Fabry-Perot interferometer is a relatively fine wavelength or narrow band filter that passes optical signals having multiple wavelengths corresponding to the multiple optical paths of the Fabry-Perot Etalon 214. A third photodiode 216 is positioned in the direction of propagation of the incident beam 42 after the Fabry-Perot Etalon 214. The third photodiode 216 detects the multiple wavelengths corresponding to the multiple optical paths of the Fabry-Perot Etalon 214 and generates a third electrical signal that is proportional to the optical power in the beam transmitted by the Fabry-Perot

Etalon 214. A signal processor 58 receives the first, second, and third electrical signals and generates an output signal that characterizes the optical beam 42. (col. 9, lines 3-58)

Thus, *Munks* merely discloses a beam splitter 90 and a second beam splitter 202 which splits a beam from beam splitter 90 into first and second optical paths and which may be a cylindrical lens. Nothing in *Munks* shows, teaches or suggests a) a cylindrical lens which configures a laser beam <u>from a semiconductor laser</u> as claimed in claims 1, 3, 37 and 39 or b) a cylindrical lens which forms a uniaxially converged laser beam as claimed in claim 39. Rather, *Munks* clearly discloses that a) the second beam splitter 202 is configured to receive the laser beam from the first beam splitter 90 and <u>not</u> from the semiconductor laser as claimed in claims 1, 3, 37 and 39 and b) the second beam splitter is used to <u>split</u> a beam into first and second optical paths and thus does not uniaxially <u>converge</u> a laser beam as claimed in claim 39.

Additionally, nothing in *Munks* shows, teaches or suggests replacing the non-shown collimating lens which is positioned in the path of the incident optical beam 42 with a cylindrical lens.

A combination of *Ohshima et al.* and *Munks* would merely suggest to replace the beam splitter 36, the optical lens 37 and photodiode 38 of *Ohshima et al.* with the second beam splitter 202 and first and second photodiodes 208, 209 of *Munks*. Thus, nothing in the combination of *Ohshima et al.* and *Munks* shows, teaches or suggests a) a cylindrical lens configured to allow a laser beam emitted from a semiconductor laser to pass therethrough as claimed in claims 1, 3, 37 and 39 or b)

directing a laser beam through a cylindrical lens to form a uniaxially converged laser beam as claimed in claim 39.

Since nothing in the combination of *Ohshima et al.*, and *Wakabayashi et al.* or *Munks* shows, teaches or suggests the invention as claimed in claims 1, 3, 37 and 39 as discussed above, Applicants respectfully request the Examiner withdraws the rejection to claims 1, 3, 37 and 39 under 35 U.S.C. §103.

Claims 2, 13-16 and 40 depend from claims 1, 3, 37 and 39 and recite additional features. Applicants respectfully submit that claims 2, 13-16 and 40 would not have been obvious within the meaning of 35 U.S.C. §103 at least for the reasons as set forth above. Therefore, Applicants respectfully request the Examiner withdraws the rejection to claims 2, 13-16 and 40 under 35 U.S.C. §103.

Claims 1-3, 13-18, 37, 39 and 40 were rejected under 35 U.S.C. §103 as being unpatentable over *Le Gall et al* (U.S. Publication 2002/0061039) in view of *Wakabayashi et al* or *Munks*.

Applicants respectfully traverse the Examiner's rejection of the claims under 35 U.S.C. §103. The claims have been reviewed in light of the Office Action, and for reasons which will be set forth below, applicants respectfully request the Examiner withdraws the rejection to the claims and allows the claims to issue.

Le Gall et al appears to disclose a method of adjusting the wavelength of lasers and a wavelength stabilization monitor for regulating the wavelength of a laser, comprising an optical input, a splitter, a wavelength filter in one branch, and two photodetectors. (paragraph 0001) The advantage of the wavelength monitor and the method is that it is easily possible to adapt the monitor to different wavelengths by moving building blocks comprising several components toward each

other. Here a wavelength filter is used which is not tunable and thus has reduced sensitivity in respect of mechanical problems. The method allows an optimal adaptation for a wavelength in a mounting process with an additional step of fixing the building block toward each other. (paragraph 0004) FIG. 6 shows a wavelength monitor is mounted on two different building blocks 12 and 13. The building block 12 comprises the laser diode 7, the dispersive element 9 and the two photodiodes the wavelength monitoring photodiode 10 and the power monitoring photodiode 11. The building block 13 comprises the collimating lens 8. In the drawings the beam separation is made by spatial splitting. Other means to do the separation (cube beam splitter, separating plates. . .) could be used as well. The type of dispersive element is not precise as well since it can be Fabry-Perot etalon or interferential filter. In fact, all wavelength filters could fit as long as they have sufficient spectral sensitivity to the angle of incidence of the input beam. (paragraphs 0021, 0022) The method used to adjust the wavelength monitor in the right position starts with two building blocks, at least on of them movable fixed on a base plate. The laser diode is connected to the driver circuit to run. The laser beam is analyzed by the photodiodes and the connected electronic circuit. The method for analyzing the electrical signal of the photodiodes is not the core of the invention. This analysis can made in a way described in prior art, e.a. the U.S. Pat. No. 4,583,228. This measurements show that is necessary to move the building blocks towards another. The building blocks are carefully moved up to a position where the photodiodes signals show a perfect zero transit signal at the desired wavelength. Then the building blocks are fixed on the base plate or to each other. The fixation can be

done by laser welding for example using a YAG-laser or any other fixation method. (paragraph 0027)

Thus, *Le Gall et al* merely discloses adjusting a wavelength monitor by moving building blocks containing a laser diode 7 and a collimating lens 8 relative to one another. Nothing in *Le Gall et al* shows, teaches or suggests a cylindrical lens as claimed in claims 1, 3, 37 and 39. Rather, *Le Gall et al* merely discloses moving a collimating element relative to a laser source.

As discussed above, *Wakabayashi et al* merely discloses a beam folding unit used in a narrow band laser apparatus. Nothing in *Wakabayashi et al* shows, teaches or suggests a cylindrical lens which is configured to allow a laser beam which is emitted from a semiconductor laser to pass therethrough as claimed in claims 1, 3, 37 and 39. Rather, *Wakabayashi et al* merely discloses a beam folding unit as part of a narrow band laser apparatus.

A combination of *Wakabayashi et al* and *Le Gall et al* would merely suggest to use the folding apparatus in the laser beam apparatus as taught by *Wakabayashi et al* within the laser source 7 of *Le Gall et al*. Thus, nothing in the combination of *Le Gall et al* and *Wakabayashi et al* shows, teaches or suggests a cylindrical lens configured to allow a laser beam emitted from a semiconductor laser to pass therethrough as claimed in claims 1, 3, 37 and 39.

As discussed above, *Munks* merely discloses a second beam splitter 202 which receives a reflected portion of a beam from a first beam splitter 90. Nothing in *Munks* shows, teaches or suggests a cylindrical lens configured to allow a laser beam emitted from a semiconductor laser to pass therethrough as claimed in claims 1, 3, 37 and 39. Rather, *Munks* teaches away from the claimed invention since the

second beam splitter 202 receives a reflected portion of a beam split by a first beam splitter 90.

Additionally, *Munks* merely discloses that the second beam splitter 202 splits a beam into first and second optical paths 204, 206. Thus, nothing in *Munks* shows, teaches or suggests a cylindrical lens which forms a uniaxially converged laser beam as claimed in claim 39. Rather, *Munks* teaches away from the claimed invention and forms divergent paths 204, 206.

Finally, nothing in *Munks* shows, teaches or suggests replacing the non-shown collimating lens which is positioned in the path of the incident optical beam 42 with a cylindrical lens.

A combination of *Le Gall et al* and *Munks* would not be possible since *Le Gall et al* is directed to moving a collimating element relative to a laser source whereas *Munks* discloses stationary mounted elements. Even assuming *arguendo* that the references could be combined, the combination would merely suggest to replace the movable collimating element 8 of *Le Gall et al* with the first and second beam splitters 90, 202 of *Munks*. Therefore, nothing in the combination of *Le Gall et al* and *Munks* shows, teaches or suggests a) a cylindrical lens configured to allow a laser beam emitted from a semiconductor laser to pass therethrough as claimed in claims 1, 3, 37 and 39 or b) a cylindrical lens which forms a uniaxially converged laser beam as claimed in claim 39.

Since nothing in *Le Gall et al*, with *Wakabayashi et al* or *Munks* shows, teaches or suggests the invention as claimed in claims 1, 3, 37 and 39 as discussed above, applicants respectfully request the Examiner withdraws the rejection to claims 1, 3, 37 and 39 under 35 U.S.C. §103.

Claims 2, 13-18 and 40 depend from claims 1, 3, 37 and 39 and recite additional features. Applicants respectfully submit that claims 2, 13-18 and 40 would not have been obvious within the meaning of 35 U.S.C. §103 over *Le Gall et al*, with *Wakabayashi et al* or *Munks* at least for the reasons as set forth above. Therefore, applicants respectfully request the Examiner withdraws the rejection to claims 2, 13-18 and 40 under 35 U.S.C. §103.

Claims 4, 5 and 8 were rejected under 35 U.S.C. §103 as being unpatentable over *Ohshima et al* or *Le Gall et al* in view of *Wakabayashi et al* or *Munks* and further in view of *Greve et* al (U.S. Patent No. 5,095,476). In addition, claims 6-7 were rejected under 35 U.S.C. §103 as being unpatentable over *Ohshima et al* or *Le Gall et al* in view of *Wakabayashi et al* or *Munks* and further in view of *Takahashi* (U.S. Patent No. 5,224,084). Claims 9-12, 19-29 and 39 were rejected under 35 U.S.C. §103 as being unpatentable over *Ohshima et al* or *Le Gall et al* in view of *Wakabayashi et al* or *Munks* and further in view of *Noguchi et al* (U.S. Patent No. 3,951,509). Claims 30-32 were rejected under 35 U.S.C. §103 as being unpatentable over *Ohshima et al* or *Le Gall et al* in view of *Wakabayashi et al* or *Munks* and *Noguchi et al* and further in view of *Takahashi.* Claims 33-36 were rejected under 35 U.S.C. §103 as being unpatentable over *Ohshima et al* or *Le Gall et al* in view of *Wakabayashi et al* or *Munks* and further in view of *Broutin et al* (U.S. Patent No. 6,272,157).

Applicants respectfully traverse the Examiner's rejection of the claims under 35 U.S.C. §103. The claims have been reviewed in light of the Office Action, and for reasons which will be set forth below, applicants respectfully request the Examiner withdraws the rejection to the claims and allows the claims to issue.

As discussed above, since nothing in the combination of the primary references shows, teaches or suggests the primary features as claimed in claims 1, 3, 37 and 39, applicants respectfully submit that the combination of the primary references with the secondary references will not overcome the deficiencies of the primary references. Therefore, applicants respectfully request the Examiner withdraws the rejection to claims 4-12, 19-36 and 38 under 35 U.S.C. §103.

The prior art of record, which is not relied upon, is acknowledged. The references taken singularly or in combination do not anticipate or make obvious the claimed invention.

Thus it now appears that the application is in condition for reconsideration and allowance. Reconsideration and allowance at an early date are respectfully requested. Should the Examiner find that the application is not now in condition for allowance, applicants respectfully request that this response be entered for purposes of appeal.

If for any reason the Examiner feels that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed within the currently set shortened statutory period, applicants respectfully petition for an appropriate extension of time. The fees for such extension of time may be charged to our Deposit Account No. 02-4800.

In the event that any additional fees are due with this paper, please charge our Deposit Account No. 02-4800.

Respectfully submitted,

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